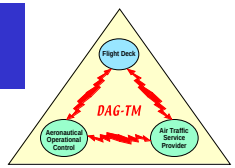


Concept Element 7

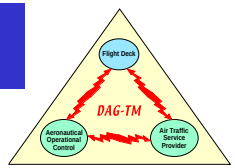
En route: [TFM] Collaboration
for
Mitigating Constraints Due to
Wx, SUA, and Airspace Complexity (Congestion)

Steve Green

Distributed Air Ground Traffic Management (DAG-TM)

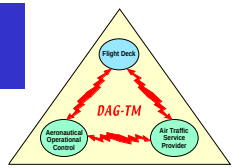
Industry Workshop

May 23, 2000



Outline

- Concept Element Overview
- Research Issues
- Technology Development
- Research Plan
- Additional Presentations



Collaboration for Wx, SUA, and Complexity Constraints (CE-7)

Problem:

Excessive and un-preferred local-TFM deviations due to inefficient use of en route airspace

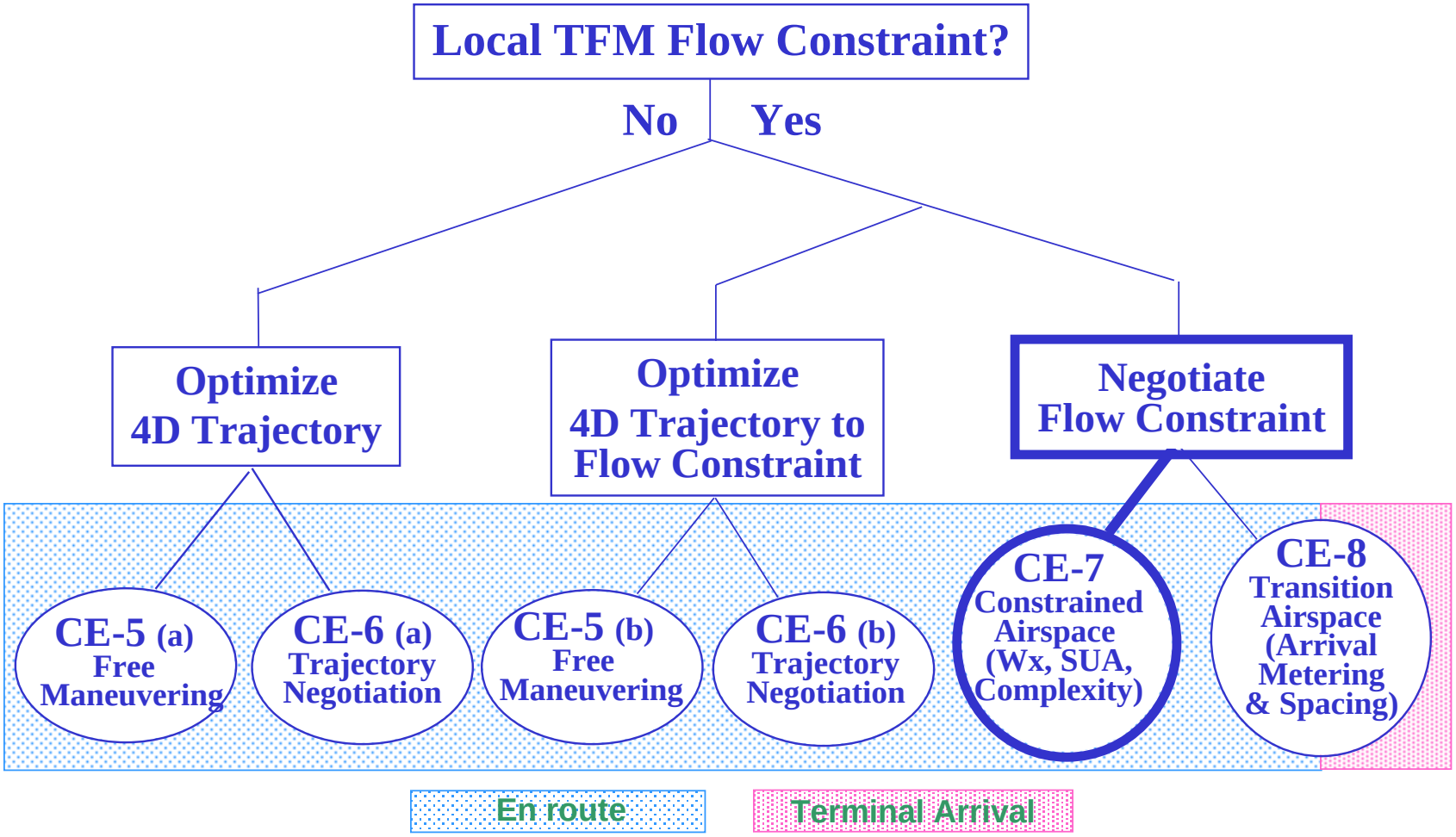
Solution:

- **Provide the user with timely and accurate predictions of the state of the NAS (Weather, SUA activation, & airspace complexity constraints)**
- **Improve the prediction accuracy of NAS state**
- **Develop DSTs and procedures to:**
  - » **Improve local-TFM decisions and User plans/preferences (AOC & aircraft)**
  - » **Facilitate collaboration on the:**
    - **Type, extent, and implementation of local TFM initiatives (Users & ATSP)**
    - **Dynamic access to SUA (SUA authorities, ATSP, & Users)**

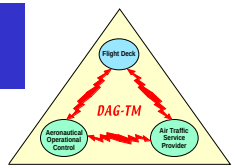
Benefits:

- **Increased user flexibility/efficiency in congested en route airspace**
- **Increased ATSP productivity and improved control of sector workload**

Mapping of En route Concept Elements 5-8



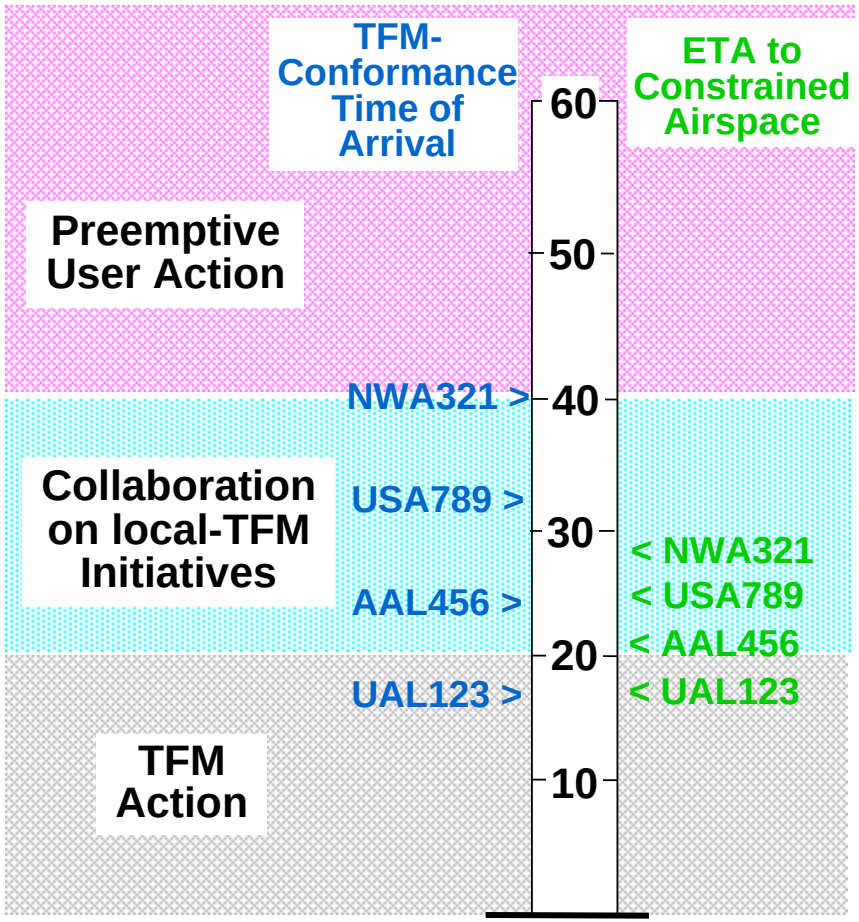
TFM = Traffic Flow Management



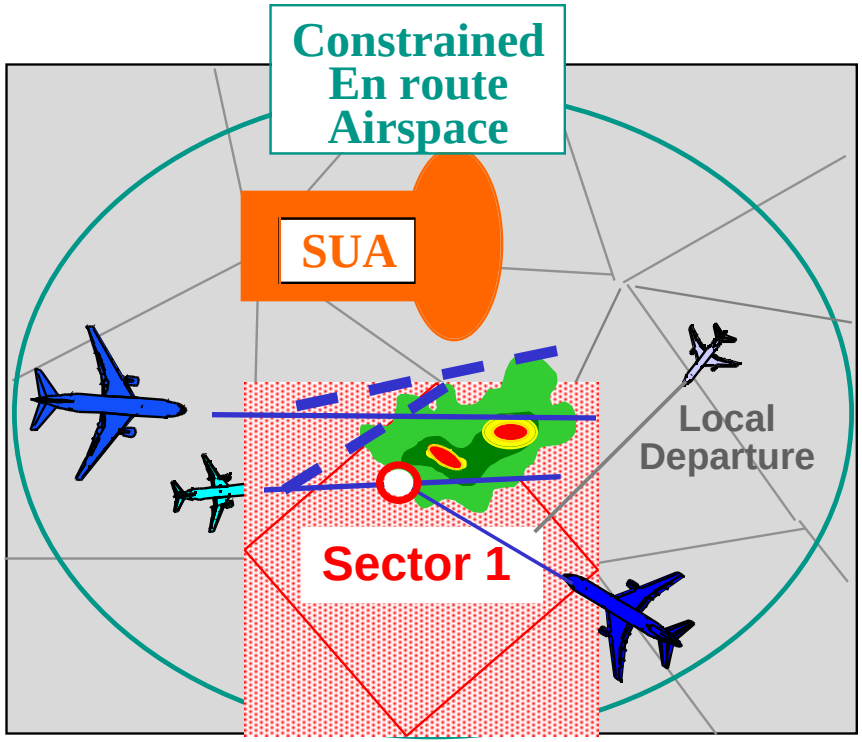
Summary of CE-7 Unique Features

- **Distributed**
  - **Information**
  - **Flow-restriction decision making**
- **Responsibilities:**
  - **ATSP (TFM)**
    - » **Update and communicate the status of the NAS**
    - » **Establish flow restrictions (only as needed)**
    - » **Facilitate collaboration on extent and implementation of restrictions**
  - **User**
    - » **Maintain and communicate an accurate model of intent/preferences**
    - » **Share data with ATSP for common situational awareness**
    - » **Execute according to plan**

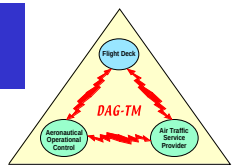
En route TFM (Constrained Airspace)



Timeline of Sector 1 Traffic Demand

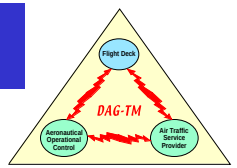


En route Air Route Traffic Control Center



Outline

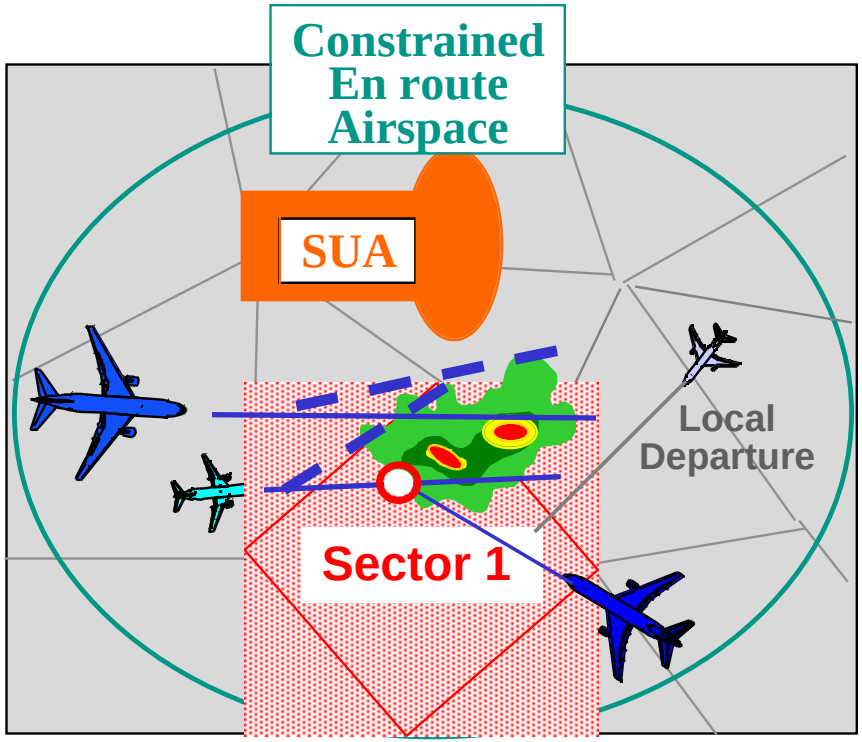
- **Concept Element Overview**
- **Research Issues**
- **Technology Development**
- **Research Plan**
- **Additional Presentations**



Research Issues

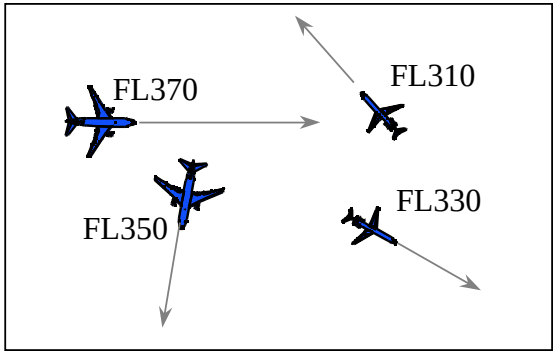
- **Better TFM**
  - **Accurate estimation of the status of the NAS**
    - » **Airspace congestion / delays**
      - **Sector complexity (workload)… Dynamic Density**
    - » **Weather**
    - » **SUA**
    - » **New modes of operation (e.g., Free Maneuvering)**
  - **Acceptable level of complexity?**
  - **TFM Decision Support Tools**
    - » **Control "Degrees of Freedom"**
  - **Inter-facility TFM coordination**
- **Collaborative Decision Making**
  - **Common User-ATSP situational awareness**
  - **Process (procedures, stability, fairness)**
  - **Flexible (negotiable) SUA**

Key NAS States

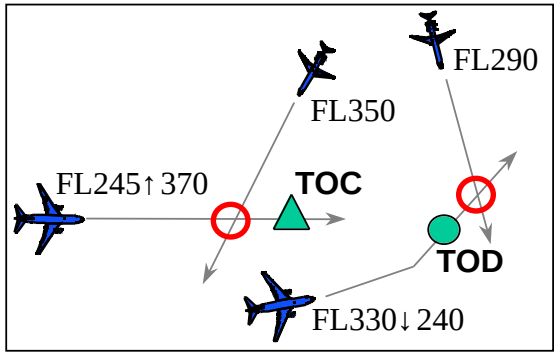


En route Air Route Traffic Control Center

Dynamic Density:
A measure of
Sector Complexity / Workload



Low Traffic Complexity



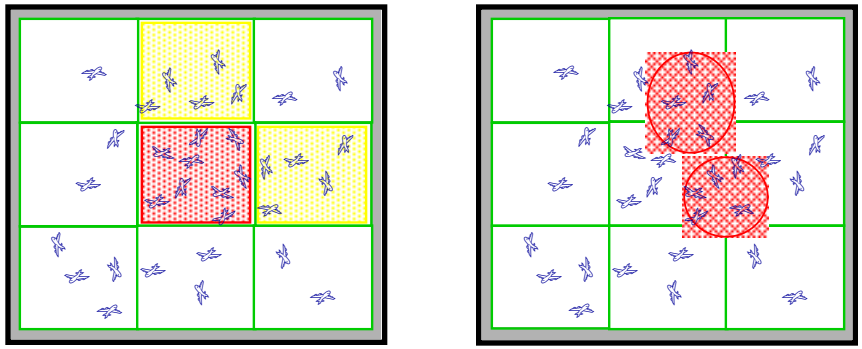
High Traffic Complexity

New Modes of Operation

- **Free Maneuvering**
  - System safety, stability and robustness
  - Complement separation assurance with dynamic TFM constraints

Dynamic Density

Discretized to airspace boundaries… Prevent sector overload.



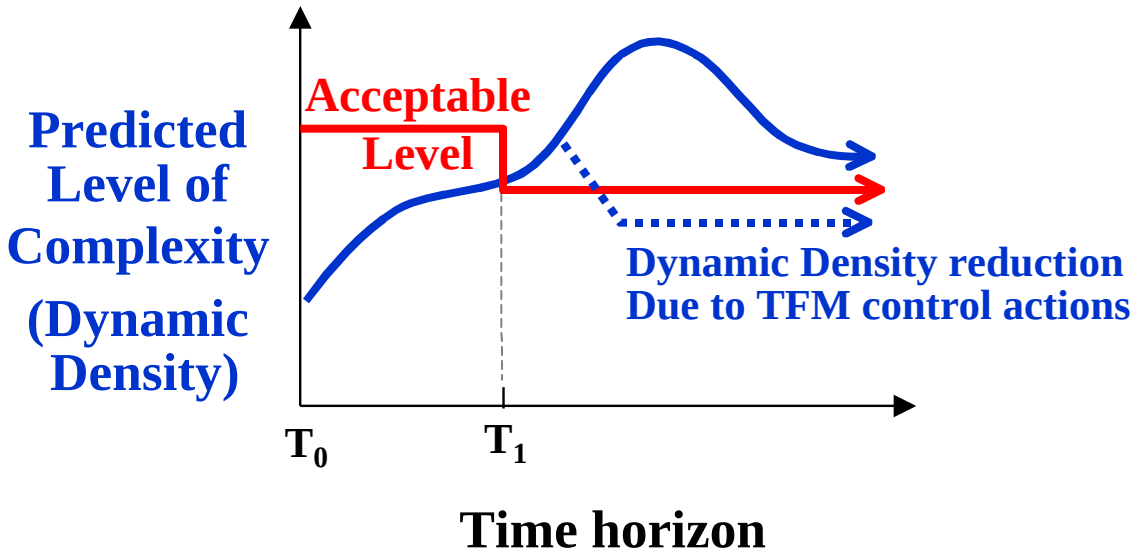
"Gaggle" Density

Shrink wrapped to dynamic gaggles… Prevent overload of self-separating flights.

Dynamic Density vs. "Gaggle" Density

Traffic Flow Management tools for preventing un-safe gaggle "get togethers" via minimal RTA constraints

Acceptable Levels of Complexity?

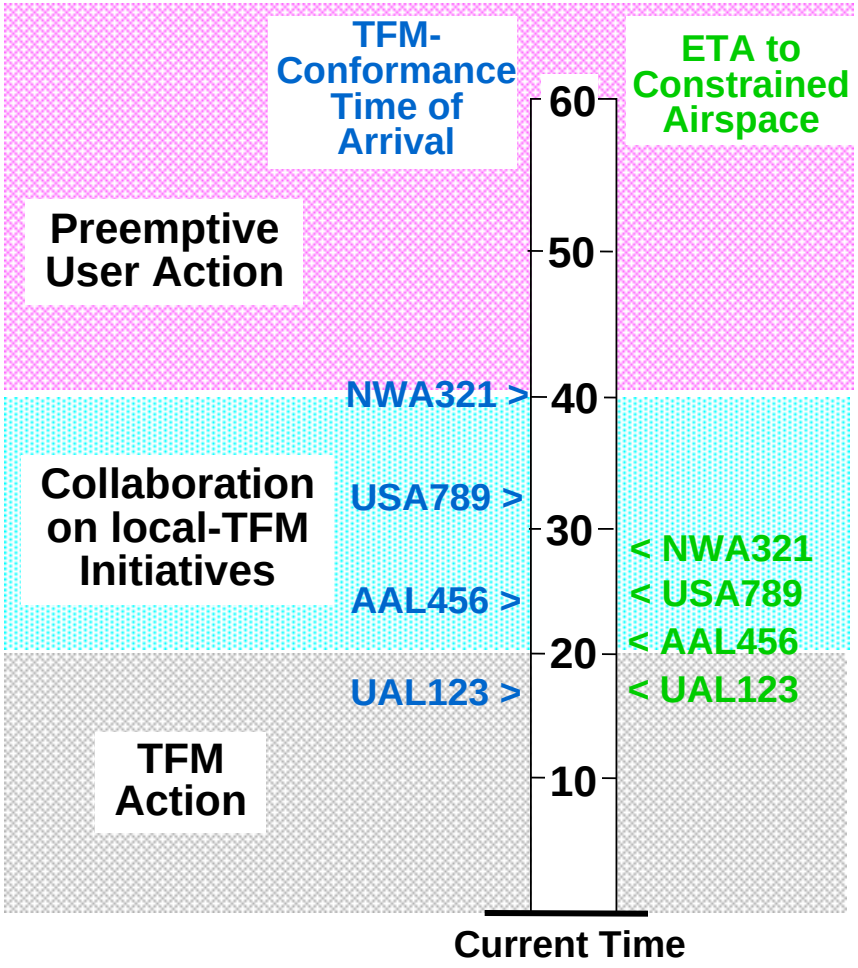


CDM & TFM Control "Degrees of Freedom"

Local Traffic Flow Management

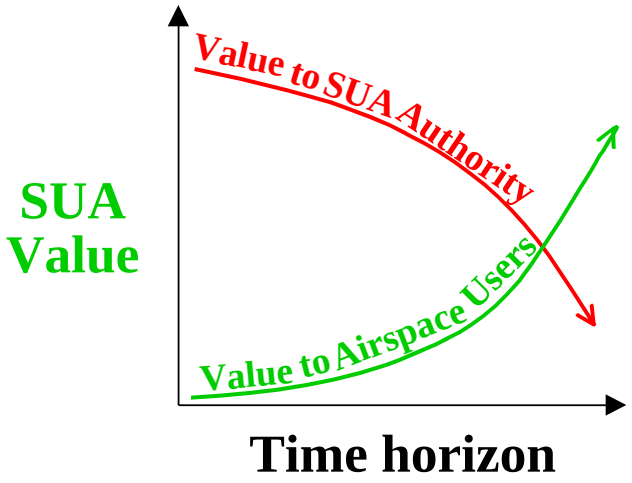
- Key NAS State:
  - Sector congestion/complexity (dynamic density)

- **TFM "controls" (initiatives)**
  - **Re-routing**
  - **Spacing**
    - » **En route**
    - » **Departure control**
  - **Dynamic access to SUA**
  - **Dynamic re-sectorization**

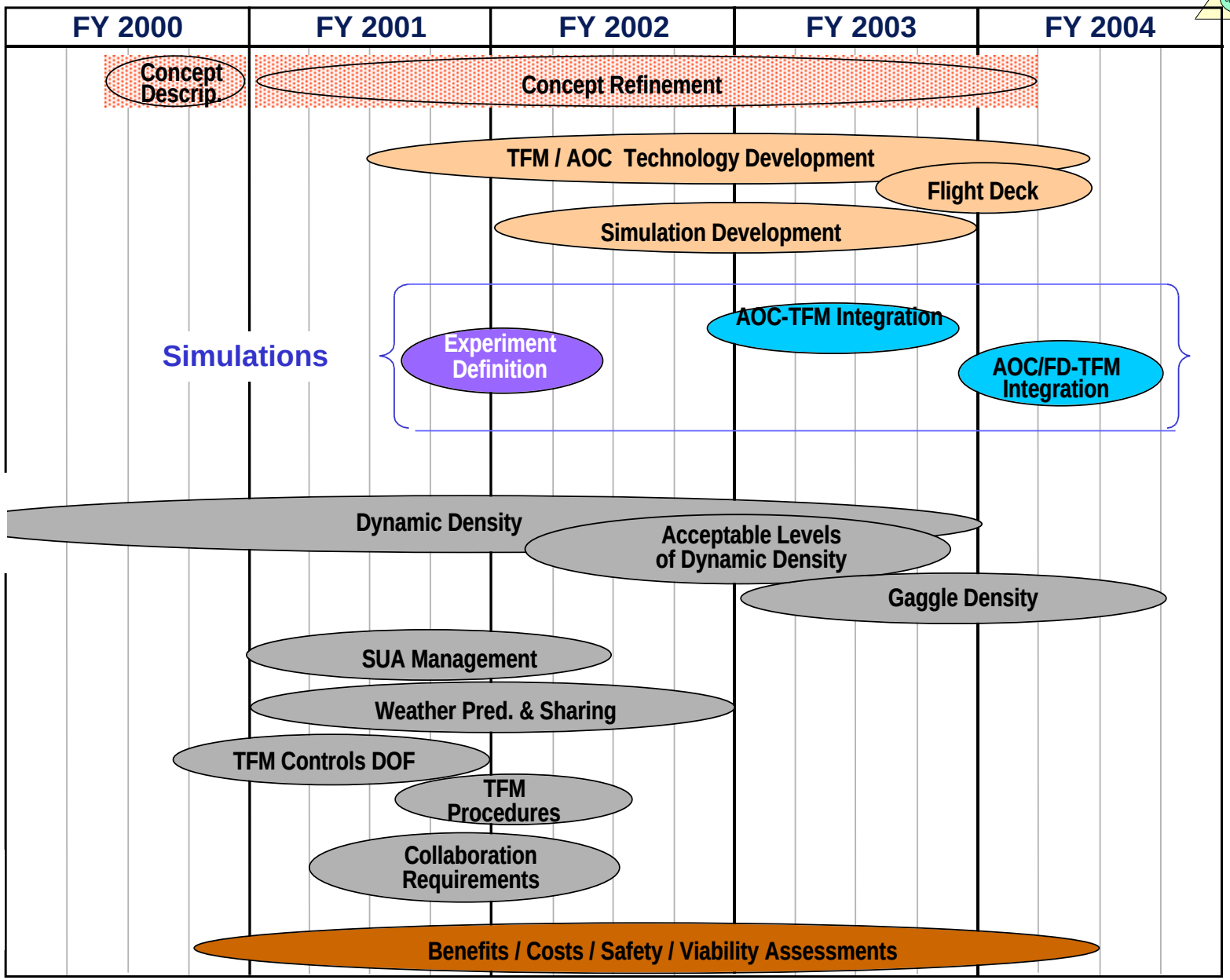


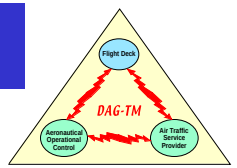
Timeline of Sector 1 Traffic Demand

Dynamic Access / Negotiation of SUA



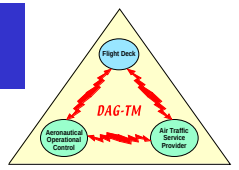
En route TFM (Constrained Airspace)





Research & Development Status

- **Constrained airspace problem defined**
  - **Concept proposed for improved TFM with gap analysis of the related R&D activities in the U.S.**
  - **Context established relative to earlier FAA/TFM concepts and current Free Flight and CDM activities**
- **Assessments of TFM strategies**
  - **Routing for local congestion and metering for arrival spacing**
- **Exploration of collaboration issues/process**
  - **National ground delay program and flight plan/re-routing**
  - **Operational issues / processes for collaboration during flight operations, specifically user-preferred sequences during CTAS arrival metering**
- **Constraint measurement and prediction**
  - **Dynamic density metric development and validation**
  - **Weather prediction technology (initiating collaborations)**



Session Presentations

- **Banavar Sridhar, NASA**

  "Dynamic Density and its Application to Traffic Flow Man."

- **Tony Chambliss, MITRE/CAASD**

  "Collaborative Routing and Coordination Tools (CRCT)"

- **Chris Brinton, Metron**

  "Sector Metering"